

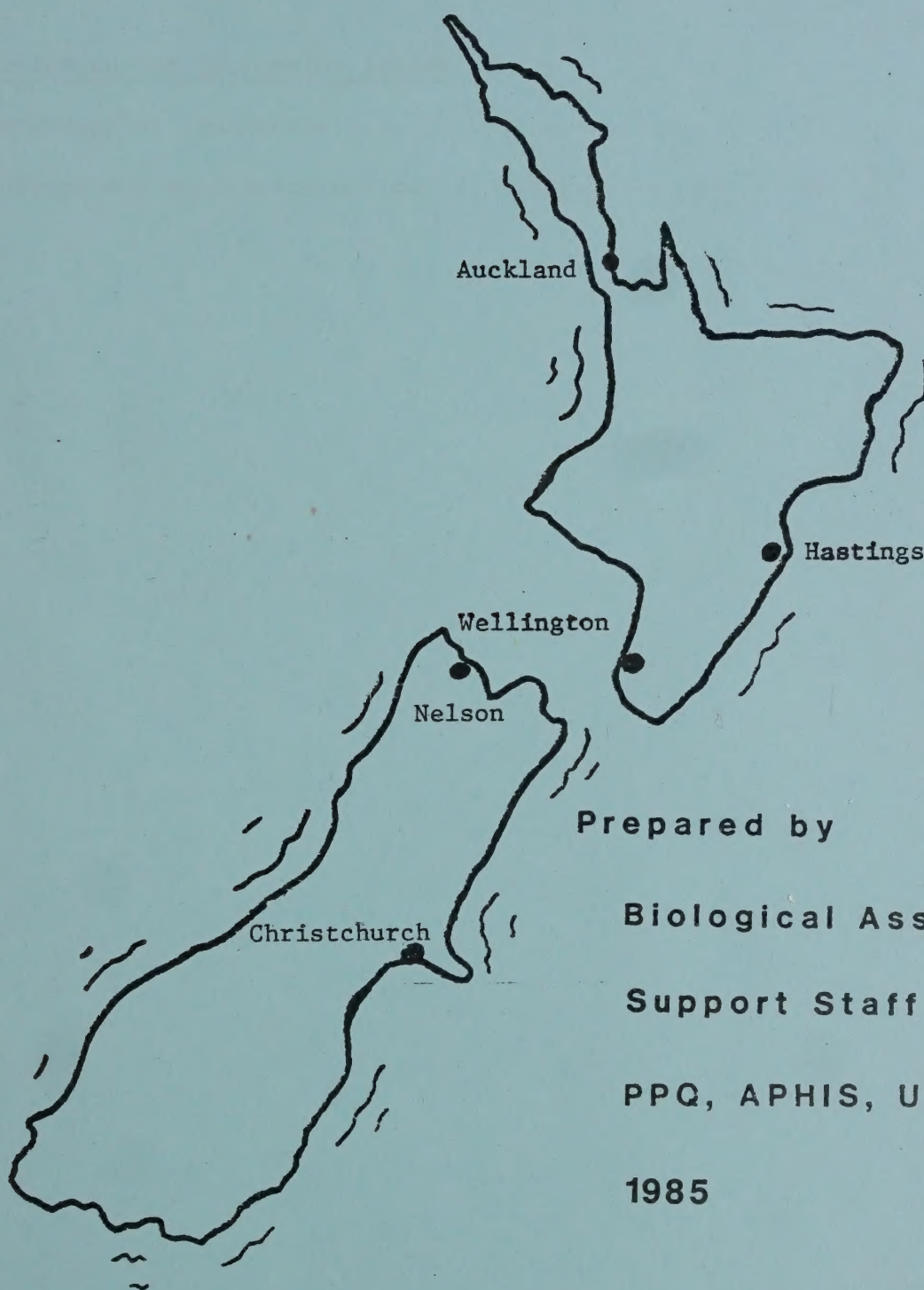
## **Historic, Archive Document**

Do not assume content reflects current scientific knowledge, policies, or practices.



Reserve  
aSB950  
.3  
.N45P67  
1985

# PPQ FOREIGN-SITE TECHNICAL PACKET for NEW ZEALAND



Prepared by

Biological Assessment  
Support Staff

PPQ, APHIS, USDA

1985





## CONTENTS

<u>I. Biological and Interception Data</u>	<u>Pages</u>
A. Tortricidae .....	1-14
B. Other Common Interceptions .....	15-23
C. Helpful References .....	24
 <u>II. Interception and Quarantine Action</u>	
A. Interception Procedures .....	25
B. Appropriate Quarantine Action .....	26

**United States  
Department of  
Agriculture**



**National Agricultural Library**



## Tortricid Larvae on New Zealand Apples and Pears

### 1. Commonly Occurring Species

There are a number of tortricids infesting apples and pears in New Zealand. They represent a potentially high pest risk to the United States fruit industry. Three important quarantine species which are intercepted on apples and pears are:

Ctenopseustis obliquana (Walker) "brown headed leaf roller"

Epiphyas postvittana (Walker) "light brown apple moth"

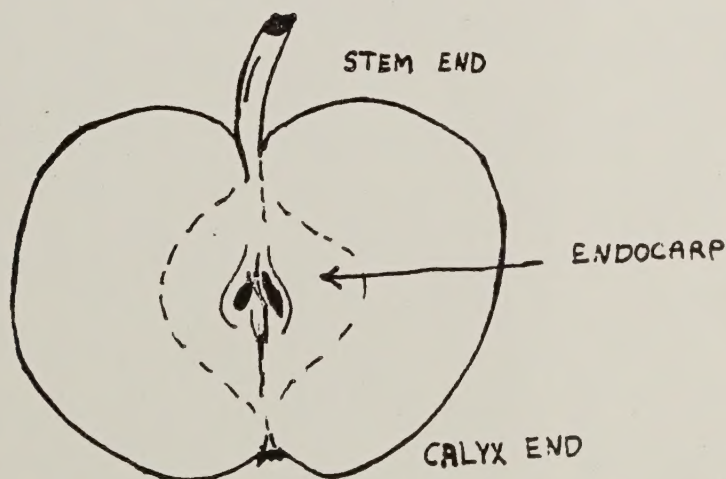
Planotortrix excessana (Walker) "apricot leaf roller"

### 2. Feeding Habits

Larval feeding of tortricids is predominately on foliage: rolling, folding, and webbing leaves together. Feeding on the fruit is incidental. Because we only inspect graded fruit, the incidence of larval infestation is reduced. Usually, larvae feed on the fruit externally under protection of webbing. The type of damage is quite obvious--the side of the fruit is chewed out. However, this type of damage is seldom seen because damaged fruit has been culled out through the grading process.

What this means to the inspector is that the presence of larvae is difficult to detect. You must have good lighting and be very thorough in your inspection. This will require cutting of fruit. Anything less than this will be too superficial to detect anything.

If there are larvae in the fruit you are inspecting, they will be early stages of a very small size. Larvae can be found in the calyx, stem, and endocarp areas of the fruit.



U.S. DEPARTMENT OF AGRICULTURE  
NATIONAL AGRICULTURAL LIBRARY

NOV 1 1996

CATALOGING PREP.





### 3. Inspectional Techniques

a. Look for external signs such as feeding on the skin of the fruit and the area around the stem.

b. Look for webbing at the calyx end and any evidence of feeding on any of the external calyx structures.

c. If no external signs of the larva are present, you must probe. Take your pocket knife blade and gently probe the calyx area. If you discover frass from a feeding larva, cut out the calyx area or cut below it and break the apple open. The larva will be found at the calyx end or in the endocarp. Initial probing of the calyx with a knife blade will detect many larvae that would otherwise be overlooked. Simple probing does not injure the apple.

### 4. Life Cycle

These insects spend their entire life cycle on the plant; eggs are laid on leaves or fruit and larvae web, roll, and feed on leaves. A more complete description of the life history for E. postvittana is given on the next page.



PESTS NOT KNOWN TO OCCUR IN THE UNITED STATES OR OF LIMITED DISTRIBUTION, NO. 50: LIGHT-BROWN APPLE MOTH

Prepared by K. Whittle, Biological Assessment Support Staff, PPQ, APHIS, USDA, Federal Building Room 634, Hyattsville, MD 20782

Pest	LIGHT-BROWN APPLE MOTH <u>Epiphyas postvittana</u> (Walker)
Selected Synonyms	<u>Austrotortrix postvittana</u> (Walker) <u>Tortrix postvittana</u> Walker
Order: Family	Lepidoptera: Tortricidae
Economic Importance	The larva of <u>Epiphyas postvittana</u> is a serious pest of fruit and ornamentals in Australia and New Zealand. As a pest of pome fruits, particularly apples, it probably ranks second to <u>Cydia pomonella</u> (L.), codling moth. During a severe outbreak, damage by <u>E. postvittana</u> to fruit may be as much as 75 percent. In Tasmania, this species is the most injurious pest of apples. In years of abundance, populations of the light-brown apple moth may cause as much as 25 percent loss of the apple crop. This pest damages fruit in storage; a few larvae may ruin a whole case. The markings on the fruit render it unfit for export (Danthanarayana 1975, Evans 1937).
Hosts	Larvae of light brown apple moth feed on a wide range of plants. Hosts include <u>Acacia</u> spp. (wattles), <u>Actinidia chinensis</u> (kiwi), <u>Adiantum</u> sp., <u>Amaranthus hybridus</u> (smooth pigweed), <u>Amaranthus patulus</u> (foxtail), <u>Aquilegia</u> sp., <u>Arbutus</u> sp., <u>Arctotheca calendula</u> (capeweed), <u>Artemisia</u> sp., <u>Astartea</u> sp., <u>Aster subulatus</u> (bushy starwort), <u>Baccharis</u> sp. (groundsel-bush), <u>Boronia ledifolia</u> (boronia), <u>Brassica oleracea</u> (wild cabbage), <u>Breynia</u> sp., <u>Buddleia</u> sp., <u>Bursaria</u> sp., <u>Calendula officinalis</u> (pot-marigold), <u>Callistemon</u> sp., <u>Camellia</u> sp., <u>Campsis</u> sp., <u>Cassia</u> sp., <u>Ceanothus</u> sp., <u>Centranthus</u> sp., <u>Centranthus ruber</u> (red valerian), <u>Chamaecyparis lawsoniana</u> (Port-Orford-cedar), <u>Chenopodium album</u> (lambsquarters), <u>Choisya</u> sp., <u>Chrysanthemum</u> sp. (chrysanthemum), <u>Citrus</u> sp., <u>Clematis</u> sp., <u>Clerodendron</u> sp., <u>Correa speciosa</u> , <u>Cotoneaster</u> sp., <u>Crataegus</u> sp., <u>Cucurbita pepo</u> (pumpkins), <u>Cydonia</u> sp., <u>Dahlia</u> sp., <u>Datura</u> sp., <u>Daucus</u> sp., <u>Dodonaea</u> sp., <u>Eriobotrya</u> sp., <u>Eriostemon</u> sp., <u>Escallonia</u> sp. (escallonia), <u>Eucalyptus</u> sp., <u>Euonymus</u> sp., <u>Euonymus japonica</u> , <u>Euphorbia</u> sp., <u>Feijoa</u> sp., <u>Forsythia</u> sp., <u>Fragaria</u> sp. (strawberry), <u>Fortunella</u> sp., <u>Gelsemium</u> sp., <u>Genista</u> sp., <u>Gerbera</u> sp., <u>Grevillea robusta</u> (silk-oak), <u>Hardenbergia</u> sp., <u>Hebe</u> sp., <u>Hedera</u> sp. (ivy), <u>Helichrysum</u> sp., <u>Humulus lupulus</u> (hops), <u>Hypericum</u> sp. (St. John's wort), <u>Jasminum</u> sp. (jasmine), <u>Juglans regia</u> (English walnut), <u>Lathyrus</u> sp., <u>Lavandula</u> sp. (lavender), <u>Leptospermum</u> sp., <u>Leucodendron</u> sp., <u>Ligustrum</u> sp.

Light-brown apple moth,  
Epiphyas postvittana





(privet), Ligustrum ovalifolium (California privet), Linum sp., Litchi sp., Lonicera sp., Lupinus sp. (lupine), Lycopersicon esculentum (tomato), Macadamia sp., Malus sylvestris (apple), Mangifera sp., Medicago polymorpha, Medicago sativa (alfalfa), Melaleuca sp., Mentha sp. (mint), Mesembryanthemum sp. (fig-marigold), Michelia sp., Monotoca sp., Myoporum sp., Oxalis sp., Parthenocissus sp., Pelargonium sp., Persoonia lanceolata (bonewood), Petroselinum sp., Philadelphus sp., Photinia sp., Phyllanthus sp., Pinus sp. (pine), Pinus patula (Mexican yellow pine), Pinus radiata (Monterey pine), Pipturus sp., Pittosporum sp., Plantago lanceolata (buckbean), Platysace sp., Polygala sp., Polygonum sp. (knotweed), Prunus armeniaca (apricot), Prunus avium (sweet cherry), Prunus domestica (plum), Prunus persica (nectarine, peach), Pteris sp., Pulcaria sp. (fleabane), Pulcaria dysenterica (fleabane), Pyracantha sp., Pyrus communis (pear), Quercus sp. (oak), Ranunculus sp., Raphanus raphanistrum (wild radish), Reseda odorata (mignonette), Ribes spp. (currants), Ribes uva-crispa (European gooseberry), Rosa sp. (rose), Rubus fruticosus (European blackberry), Rubus hawaiiensis, Rumex acetosella (sorrel), Rumex crispus (curly dock), Salvia sp., Santalum sp., Senecio sp. (groundsel), Sida sp., Sisymbrium officinale (hedge mustard), Smilax sp., Solanum tuberosum (potato), Sollya sp., Tithonia sp., Trema sp., Trifolium glomeratum (cluster clover), Trifolium repens (white clover), Trifolium subterraneum (subterranean clover), Triglochin sp., Ulex europaeus (gorse), Urtica dioica (nettle), Vaccinium sp., Viburnum sp., Vicia faba (broadbean), Vicia hirsuta (tiny vetch), Vicia sativa (vetch), Vinca sp., Vitis sp. (grape), Wikstroemia foetida, Wilkesia sp., and Wisteria sp. (Danthanarayana 1975 and 1983, Ferro 1976, Geier and Briese 1981, Zimmerman 1978).

#### General Distribution

This species is indigenous to Australia (Queensland, New South Wales, Victoria, South Australia, and Tasmania) and has been introduced into Hawaii, New Caledonia, New Zealand, and southwestern England (Commonwealth Institute of Entomology 1957, Geier and Briese 1981). It has also been introduced into southwestern Western Australia (D. Briese, personal communication 1984).

#### Characters

ADULTS (Fig. 1) - Male smaller than female, length 5-10 mm, wingspan 12-24 mm. Wing venation in Fig. 2. Distinguished by forewing abruptly divided medially into pale basal and darker apical areas; female length 5-12 mm and wingspan 12-27 mm, forewings less marked than male's (Danthanarayana 1975, Zimmerman 1978).







Epiphyas postvittana distribution map prepared by Non-Regional Administrative Operations Office and Biological Assessment Support Staff, PPQ, APHIS, USDA

Male. Antenna weakly dentate ciliate, length of cilia about equal to width of flagellum. Forewing: basal half light buff or pale yellow; distal half dark brown, ferruginous; oblique narrow median fascia darker, inner edge sharply defined, straight, sometimes slightly sinuate at middle; pre-apical spot obscure, its inner margin usually defined by ferruginous ground color separating it from median fascia; well-developed costal fold from base to about two-fifths (Bradley, Tremewan, and Smith 1973), distinct V-shaped boundary when folded (Fig. 3) (Danthanarayana 1975). Hindwing gray (Bradley, Tremewan, and Smith 1973).

Male extremely variable with numerous recurring forms. In strongly marked forms, distal half of forewing reddish brown to blackish with purplish mottling; pale basal half may be sparsely black speckled. Lightly marked forms resemble female; extreme form with outer half of forewing light and pre-apical spot distinct (Bradley, Tremewan, and Smith 1973).

Light-brown apple moth,  
Epiphyas postvittana



(Fig. 1)



A



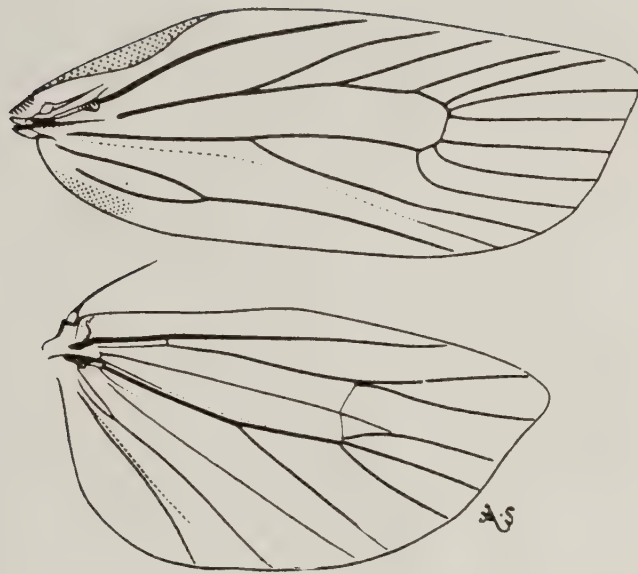
B

Epiphyas postvittana adults, dorsal view: A. Male. B. female  
(From Ferro 1976).





(Fig. 2)



Wing venation of Epiphyas postvittana male, dorsal view  
(From Zimmerman 1978).

(Fig. 3)



Epiphyas postvittana adults, dorsal view: Female (left); male  
(right) (From Geier and Briesse 1981).

Light-brown apple moth,  
Epiphyas postvittana





Male genitalia (Fig. 4A). Internal sac of aedeagus bears two to four long, narrow, flattened cornuti (Fig. 4B). These are deciduous and may be missing from mated specimens, but points of articulation can still be seen (Zimmerman 1978).

(Fig. 4)



Epiphyas postvittana: A. Male genitalia, dorsal view.  
B. Three long, rodlike cornuti, dorsal view (From Zimmerman 1978).

Female. Antenna minutely ciliate. Forewing longer than male's, apex produced, contrast between basal and distal halves less than in male, median fascia usually reduced. Variation minor, forewing irrorate with black (Bradley, Tremewan, and Smith 1973). Female genitalia (Fig. 5).

Epiphyas postvittana may be confused with Amorbia emigratella Busck (Mexican leafroller), but E. postvittana has ocelli which are lacking in A. emigratella, the undersides of the hindwings are conspicuously immaculate as in A. emigratella and the second abdominal tergite lacks the conspicuous median pit near the base which is present in A. emigratella (Zimmerman 1978).

EGGS - Pale green to pale brown, almost flat (U.S. Department of Agriculture 1957), 0.84 by 0.95 mm (Danthanarayana 1975).



(Fig. 5)



Epiphyas postvittana: Female genitalia, holotype (British Museum slide 1815) (From Zimmerman 1978).

LARVAE (Fig. 6) - First instar pale yellow, head dark brown. Later instar head and prothoracic plate pale brown. Length of full-grown larvae 10-18 mm, body medium green, darker central stripe, two side stripes (Ferro 1976).

(Fig. 6)



Epiphyas postvittana larva, lateral view (From Ferro 1976).

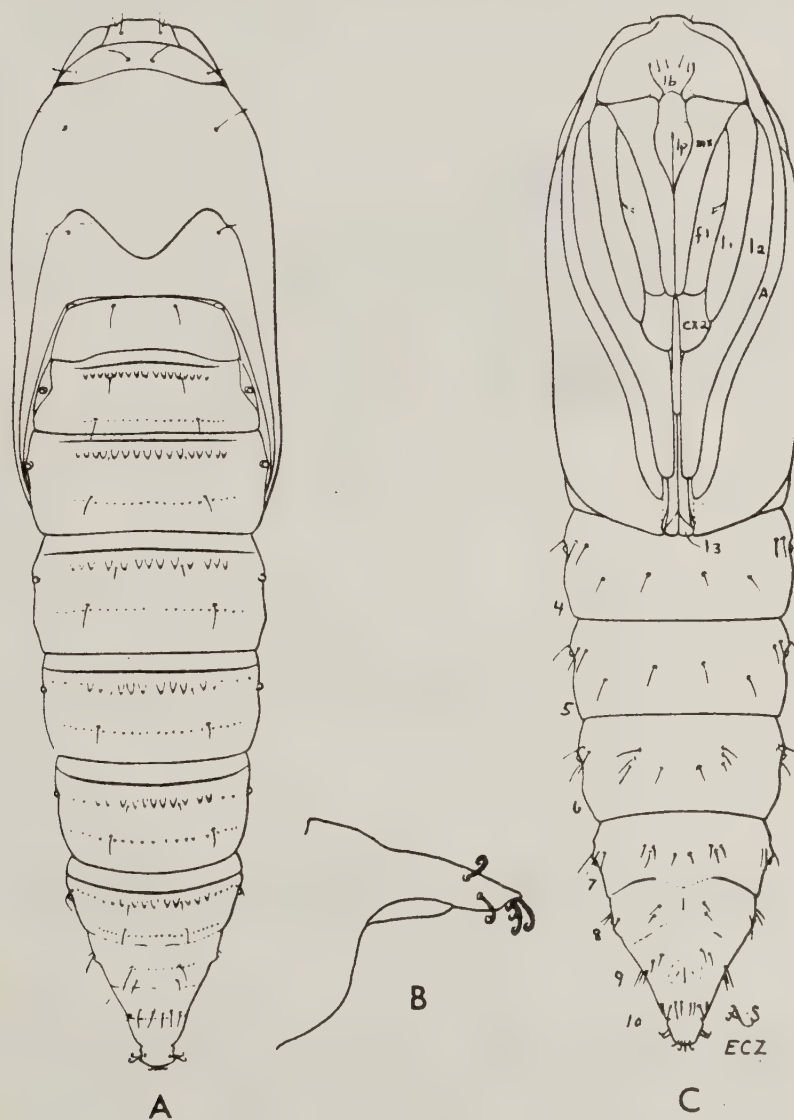




E. postvittana larvae are green, as in Amorbia emigratella, but prothorax does not have a black line on each lateral margin as does the larva of A. emigratella (Zimmerman 1978).

PUPAE (Fig. 7) - Newly formed, green; later, medium brown. Male averages 2.5 by 7.6 mm; female 2.9 by 9.8 mm (Danthanarayana 1975).

(Fig. 7)



Epiphyas postvittana pupa. A. Dorsal view. B. Cauda, left lateral view. C. Ventral view.

cx2 - Mesocoxa; f1 - profemora; lb - labrum; lp - labial palpus; l1, l2, l3 - legs; mx - galea of maxilla (proboscis) (From Zimmerman 1978).



Characteristic  
Damage

Larval feeding on fruit (Fig. 8) results in large irregular blemishes. These blemishes may callous over and the fruit remain on the tree, or wet conditions may allow the entry of rot organisms. Larvae may excavate small round pits and produce scars similar to the "stings" of the larvae of Cydia pomonella. Clusters of fruit are particularly susceptible. Larvae entering the fruit through the calyx may cause internal damage. Feeding on the foliage causes ragging and curling (Evans 1937, Ferro 1976, U.S. Department of Agriculture 1957).

(Fig. 8)



Epiphyas postvittana larva, dorsolateral view, showing damage to an apple (Geier and Briese 1981).

Detection  
Notes

The movement of this pest from country to country may occur in one of several ways. Three possible pathways are as immatures with fresh fruit, immatures with propagative material, and as adults on aircraft. Although some of its hosts are prohibited because of other pests, many of its hosts are enterable into the United States subject to inspection under various regulations, mainly Title 7, Part 318.13, Part 319.37, and Part 319.56 of the Code of Federal Regulations.

Light-brown apple moth,  
Epiphyas postvittana





The total number of E. postvittana interceptions at U.S. ports of entry was 63 in the past 13 years. Only larval and pupal stages have been intercepted. Interceptions were common on Malus sylvestris (apple) in cargo from Australia (13 times including 7 from Tasmania) and New Zealand (5). Cargo interceptions were made from Australia in Fragaria sp. (strawberry) and Pyrus communis (pear); and New Zealand in Capsicum spp. (peppers), Fragaria sp. (strawberry), Prunus spp. (cherries), P. armeniaca (apricot), P. domestica (plum), P. persica (peach), and Ribes nigrum (black currant). This pest has also been intercepted a few times in baggage and stores.

This species may be detected in the following ways.

1. Search for overlapping egg masses on leaves. The egg mass may be jet black if parasitized by Trichogramma sp. (a trichogrammatid wasp).
2. Inspect fruit for irregular brown areas, round pits, or scars. Look for evidence of feeding at the calyx end of the fruit. If no external signs of the larva are present, probe the calyx areas. If frass is discovered, cut out the calyx area below it and break the apple open. The larva will be found at the calyx end or in the endocarp.
3. Inspect for ragged and curled leaves. Open rolled up leaves to search for larvae.
4. Watch for adults resting on the underside of the leaves during the day.

## Biology

In Tasmania, adults begin appearing in orchards during early summer. They lay their eggs on apple leaves. The newly hatched larvae feed principally on the underside of leaves in silken tunnels. After about 3 weeks, they abandon their tunnels and continue feeding. They pupate in folded or webbed leaves. In late summer, another generation of moths emerges. Larvae from this generation feed as long as leaves remain on trees. When the leaves fall, the larvae drop and feed on cover crops, but they can survive on the orchard floor without feeding as long as 2 months. The next spring, they return to the trees to feed on the green shoots and later in the blossom clusters (Evans 1937, U.S. Department of Agriculture 1957).



In Australia, adults rest under leaves during the day. If disturbed, they make short erratic flights. They become active at dusk and oviposit either late in the evening or during the night. Females of the first summer generation mate shortly after emergence and lay their eggs 2 or 3 days later. They usually lay 20-25 eggs each, in partly overlapping masses on smooth surfaces, mostly on the leaves of host plants. They normally produce 100-200 eggs in a lifetime of about 10 days. Fecundity depends on the season, and under field conditions, females may lay 209-455 eggs.

After 1-2 weeks, the larvae hatch. They disperse actively, either by crawling or by dropping on silken threads, before constructing a silken shelter, often on the underside of a leaf near the midrib or a vein. After the first moult, they construct typical leaf rolls (nests) by webbing one or more leaves together, or by webbing a leaf onto the surface of a fruit. During the fruiting season, they also make nests among clusters of fruits, and sometimes tunnel into the fruits through the calyx. If disturbed, young larvae tend to withdraw to the end of their tunnels, while older larvae will wriggle violently, and either drop to the ground or hang suspended by a silken thread. The larva passes through six instars, but its appearance remains generally similar throughout, except for increase in size. Very rarely under laboratory conditions, five or seven instars develop but never four. Pupation occurs within the nests (Danthanarayana 1975 and 1983, Evans 1937, Ferro 1976, Geier and Briesse 1981, U.S. Department of Agriculture 1957).

The longest mean life span in experiments was 33 days for females and 26 days for males at about 12° C. The shortest mean life span measured was 3 days at 31° C. The pest has no winter resting stage, being active throughout the year. Adult activity is, however, much slower during the winter. There are three generations a year in Australia. The favorable temperature range is between 15 and 25° C. A long, hot summer does not support Epiphyas populations; the pest prefers regions with cool climates (Danthanarayana 1975).

#### Literature Cited

Bradley, J. D.; Tremewan, W. G.; Smith, A. Epiphyas postvittana (Walker). p. 126-127, No. 147. In: British tortricoid moths: Cochylidae and Tortricidae: Tortricinae. London, England: Johnson Reprint Co.; 1973.

Commonwealth Institute of Entomology. Distribution maps of pests. Ser. A, No. 82. London, England: Commonwealth Institute of Entomology; 1957.

Light-brown apple moth,  
Epiphyas postvittana





- Danthanarayana, W. The bionomics, distribution and host range of the light brown apple moth, Epiphyas postvittana (Walk.) (Tortricidae). Aust. J. Zool. 23(3):419-437; 1975.
- \_\_\_\_\_. Population ecology of the light brown apple moth, Epiphyas postvittana (Lepidoptera: Tortricidae). J. Anim. Ecol. 52:1-33; 1983.
- Evans, J. W. The light-brown apple moth (Tortrix postvittana Walker). Tasmanian J. Agric. 8(3, suppl.):1-18; 1937.
- Ferro, D. N. ed. New Zealand insect pests. p. 22, 34-36. Canterbury, New Zealand: Lincoln University College of Agriculture; 1976.
- Geier, P. W.; Briese, D. T. The light-brown apple moth, Epiphyas postvittana (Walker): a native leafroller fostered by European settlement. Kitching, R. L.; Jones, R. E. eds. The ecology of pests. CSIRO Australia; 1981: 131-155.
- U.S. Department of Agriculture, Agricultural Research Service, Plant Pest Control Division. Insects not known to occur in the United States: light-brown apple moth (Austrotortrix postvittana (Wlk.)). Coop. Econ. Insect Rep. 7:32; 1957.
- Zimmerman, E. C. Insects of Hawaii. Vol. 9, Microlepidoptera, Part 1, Monotrysis, Tineoidea, Tortricoidea, Gracillarioidea, Yponomeutoidea, and Alucitoidea. Honolulu, Hawaii: Univ. of Hawaii Press; 1978: 457-462.



## Biological Data on Other Common Interceptions

### A. Mites, Scales, and Mealybugs on Apples and Pears from New Zealand

Mites, scales and mealybugs are commonly found on commercial shipments of apples and pears from New Zealand. Accurate identification of these pests in the field is not completely reliable; however, notes on the most likely intercepted genera and species are given below as an aid to the tentative identification. At present, no quarantine action is required for any of the above interceptions on preclearance inspection of apples and pears from New Zealand. (See Quarantine Action section). A 10-15X hand lens is needed for field identification.

#### 1. Mites

##### Cryptostigmata (beetle mites)

Mites from the suborder, Cryptostigmata, also called "beetle mites" are commonly found on apples and pears from New Zealand. Beetle mites as the name implies resemble a small beetle. They are strongly sclerotized, about 1 mm in length, and slow moving. Their color ranges from dark brown to almost black. These mites are not plant pests, but normally saprophagous or fungivorous. Two genera have been intercepted on New Zealand apples, Scheloribates sp. and Oribotritia sp.

##### Tetranychidae (spider mites)

##### Field Identification and Life Cycles

a. Tetranychus urticae Kock - "Two spotted spider mite." This mite has a globular non-sclerotized body that is yellowish, greenish, or brownish in color, with a prominent, darker spot on each side. The hairs are not borne on whitish tubercles as in the species below. The summer form eggs are spherical and white. The form frequently found on apples is the orange overwintering adult female and the white form in late summer and early fall. This mite produces webbing.

b. Panonychus ulmi Koch - "European red mite." The European red mite has a globular, non-sclerotized body which is dark red in color. The hairs are stout and borne on whitish tubercles. It has a slightly flattened red egg with a delicate stalk on top. This mite produces little or no webbing.

c. Bryobia praetiosa Koch - "Clover mite." The clover mite has a flattened, non-sclerotized body that is either brownish or greenish in color. The hairs are short and flattened. The eggs are bright red and spherical. No webbing is produced. Usually this mite is not found in orchards where insecticidal sprays are used.

#### 2. Diaspididae (armored scales)

San Jose and greedy scales are the two most commonly intercepted armored scales on New Zealand apples.





## Field Identification

- a. Quadraspidotus perniciosus Comstock - "San Jose scale." Adult female scale is circular about 0.9 mm in diameter, slightly convex and gray in color.
- b. Hemiberlesia rapax (Comstock) - "greedy scale." Adult, female scale cover is circular about 1.0 to 2.0 mm in diameter, high convex having a strongly tipped-over appearance and gray to white in color.

### 3. Pseudococcidae (mealybugs)

The obscure and long-tailed mealbugs are the most commonly intercepted mealybugs on New Zealand apples.

- a. Pseudococcus affinis (Mask.) Essig - "obscure mealybug." Adult female is about 4.5 mm long, covered with light gray, powdery white wax, without a longitudinal strip running up the dorsal surface of the body.
- b. Pseudococcus longispinus (Targion-Tozzetti) - "long-tailed mealybugs." Adult female is about 3 mm long, covered by light gray, powdery white wax, except for a slightly darker stripe running up the middle of the dorsal surface of the body.

### B. Hitchhikers - Hemiptera

Outside of the tortricids, hitchhikers in the order Hemiptera have been the most commonly found actionable group of pests on New Zealand apples and pears. Nysius huttoni B. White, a dark brown colored lygaeid about 6 mm long has been intercepted several times. It has been reported on various crops such as wheat grass, but it is not a pest of apples. When growers do not control this type of vegetation around packing sheds, this insect becomes a problem. Additional information on this pest is given on pages 18 to 23.

Dictyous caenosus (Westwood), a brown pentatomid, has been intercepted at least once and is reported as occurring in grasses and pastures.

### C. Coccinellid Larvae

Stethorus bifidus Kapur is a predator of phytophagous mites and is often found on apples. The early larval instars are superficially similar in appearance to small tortricid larvae. When disturbed by probing, it is sluggish in movement in comparison to tortricid larvae. The coccinellid larva's body tapers to the posterior end, but the tortricid's do not. No plant feeding coccinellids are found in New Zealand; no coccinellids require action.

### D. Diseases

No quarantine significant pathogens are associated with apples and pear fruit from New Zealand. As required by Quarantine 56, the shipment should be free of plant debris.

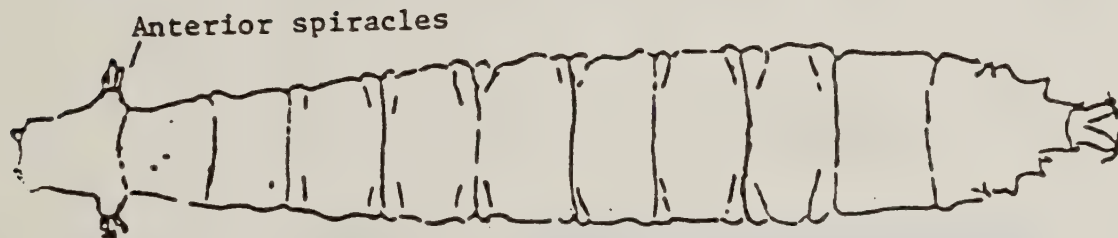


### E. Drosophilidae

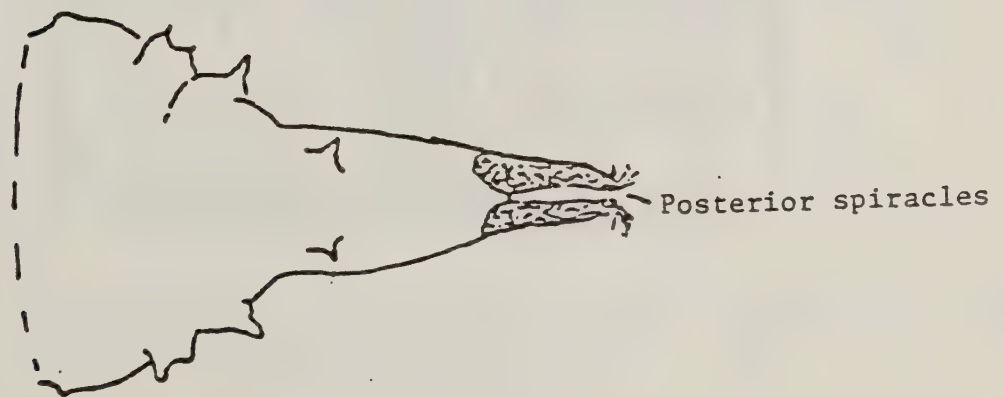
The larvae of vinegar flies (*Drosophilidae*) were intercepted commonly in apples in New Zealand in 1984. Since they attack only fruit that is already decaying, they are not of significance to PPQ.

#### Description of Larva

The larvae are generally white and muscoid in shape. They are somewhat cylindrical and tapered anteriorly, with prominent tubercles fused at the base on the last abdominal segment. The posterior spiracles are on these stalked projections.

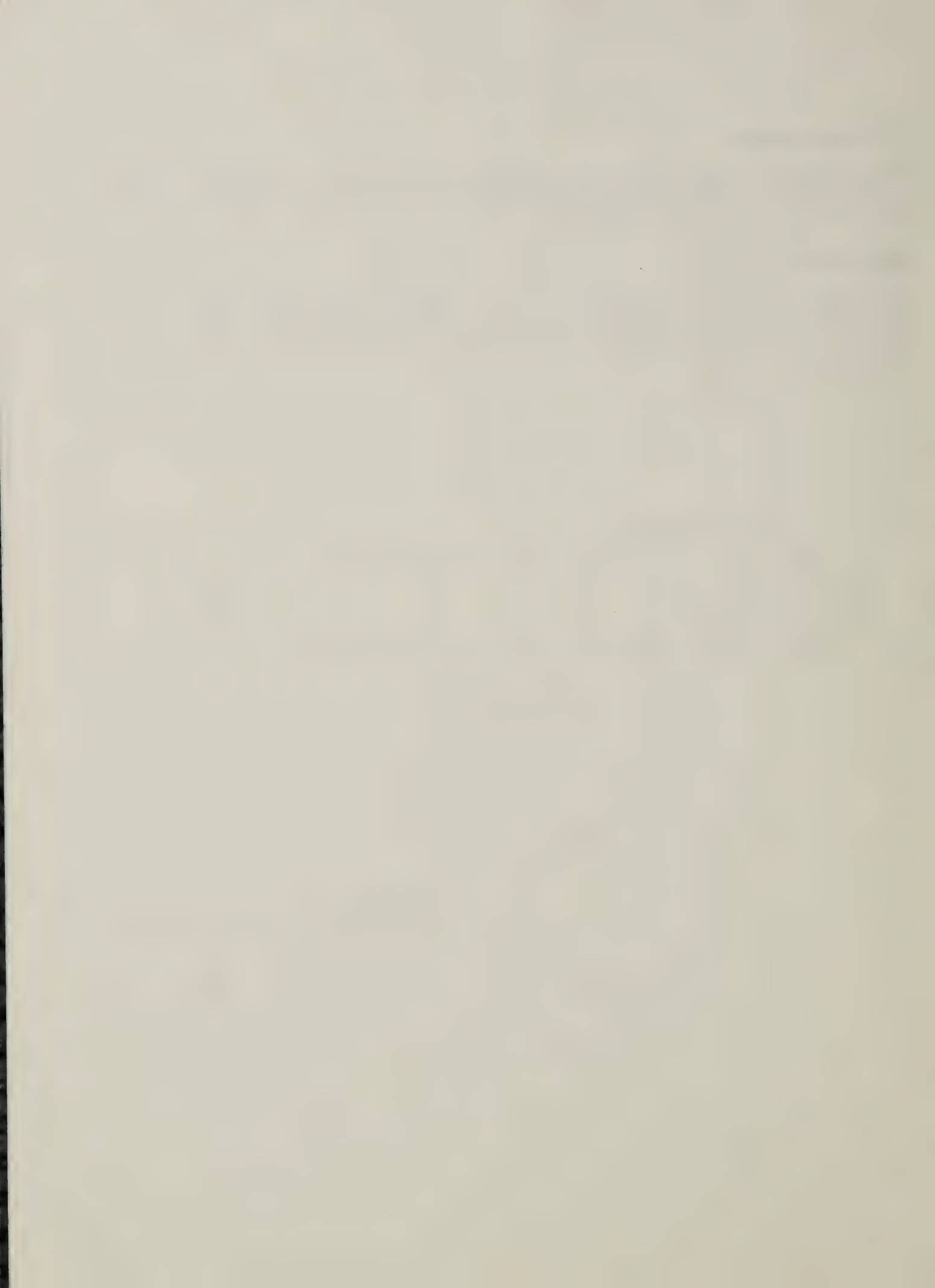


Dorsal View



Dorsal view of posterior





APHIS-PPQ

Prepared by K. Whittle\* and T. J. Henry†

APHIS 81-46  
September 1985

Pest

WHEAT BUG  
Nysius huttoni White

Order: Family

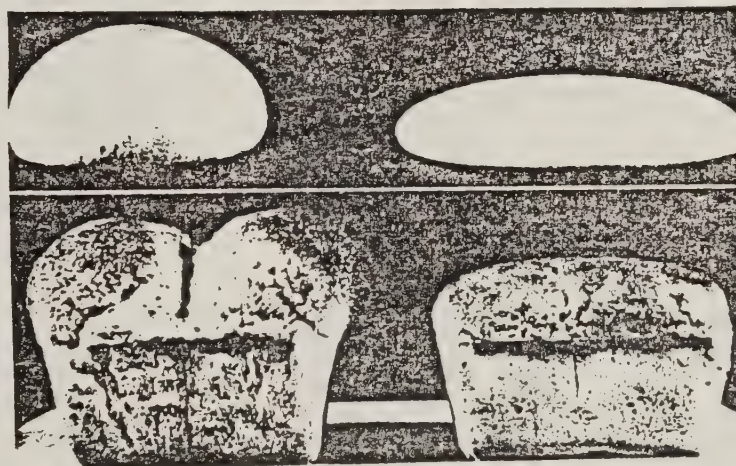
Hemiptera: Lygaeidae

Economic  
Importance

N. huttoni has been known as a pest of wheat in New Zealand since the mid-1930's. Its feeding reduces the weight of the grain but more importantly, adversely affects the flour. Seed germination is unaffected. This lygaeid is also a serious pest of young crucifers; its feeding eventually leads to seedling death ending in poor crop stands. Damage is often severe, especially in dry districts and elsewhere in dry years when serious outbreaks occur (Ferro 1976, Gurr 1957).

Because wheat bug injects an enzyme during feeding, flour from damaged wheat ruins dough during breadmaking (Fig. 1). The enzyme splits adjacent protein chains in dough, breaking down the dough structure, suddenly turning it runny and sticky. This

(Fig. 1)



Wheat doughs and loaves: Left - normal. Right - wheat damaged by Nysius huttoni (From Ferro 1976).

---

\* Biological Assessment Support Staff, PPQ, APHIS, USDA,  
Federal Building Room 634, Hyattsville, MD 20782

† Systematic Entomology Laboratory, Insect Identification and  
Beneficial Insect Introduction Institute, Agricultural Research  
Service, USDA, c/o U.S. National Museum (USNM), Washington, DC  
20560



"sticky dough" or "sticky gluten" gums up bakery machinery. Also, the resultant bread is unacceptable. As few as three to four damaged grains per 1,000 produce flour unsuited for baking (Meredith 1970).

#### Hosts

Brassica napus (rape), B. oleracea, B. rapa, Calandrinia ciliata, Capsella bursa-pastoris (shepherd's-purse), Cassinia leptophylla (silverheath cassinia), Coronopus didymus (swine-cress), Cytisus scoparius (Scotch broom), Fragaria X ananassa (garden strawberry), Lathyrus sp. (pea), Linum sp., Linum usitatissimum (flax), Medicago sativa (alfalfa), Nassella trichotoma, Rubus spp. (raspberries), Trifolium pratense (red clover), Trifolium subterraneum (subterranean clover), and Triticum aestivum (wheat) (Ferro 1976, Myers 1921, Spiller and Wise 1982).



Nysius huttoni distribution map prepared by Non-Regional Administrative Operations Office and Biological Assessment Support Staff, PPQ, APHIS, USDA





General  
Distribution

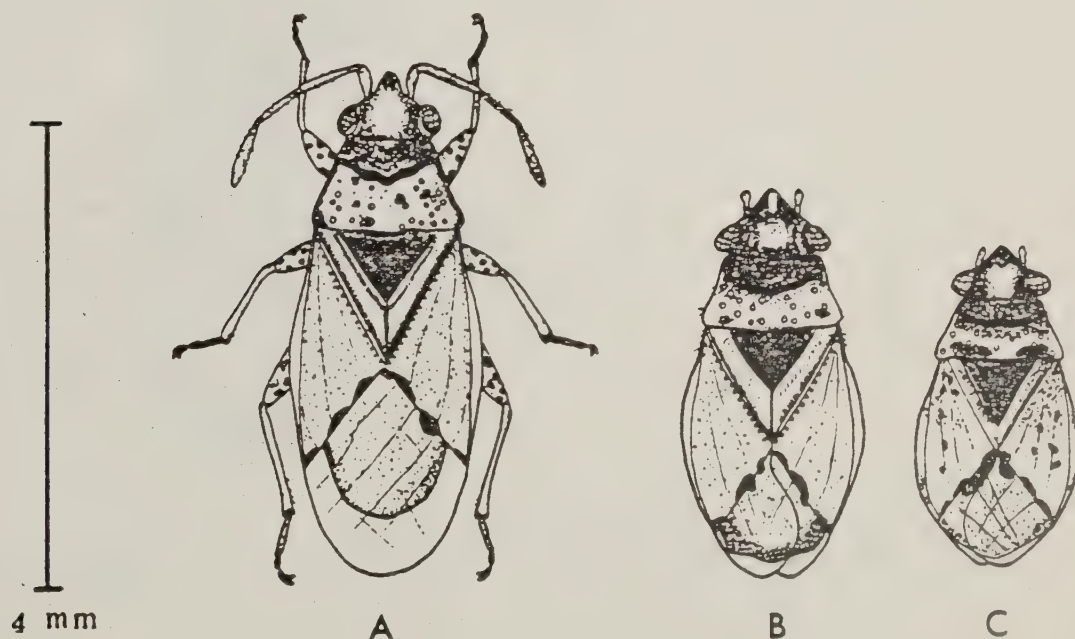
This bug is widely distributed throughout New Zealand including the Chatham Islands and Three Kings Islands (Eyles 1960).

Characters

ADULTS - Length 3.5-4.3 mm, width 1.3-1.8 mm. Dorsally clothed with short, appressed, golden to silvery, sericeous pubescence, intermixed with erect, simple setae. Head wider than long, black, mesal area yellow to reddish yellow. Antennae about twice as long as head width, brown to black, 1st segment sometimes yellowish. Pronotum trapeziform, distinctly punctate, brown, humeral angles and base of meson yellow; scutellum shiny black. Hemelytra brown, variably mottled and spotted with yellow, corial margins uniformly brown, apical margin of each corium bordering the membrane with three dark-brown spots sometimes coalesced into extensive dark area. Membrane nearly clear, cross-hatched with white lines, basal area often fuscous. Undersurface mostly black, abdomen mottled with yellow, coxal clefts yellow. Femora dark brown with apices, dorsal line, and edges broken by yellow, tibiae yellow, tarsi and claws yellow to brown.

Adults can be divided into three size groups: Large, 3.5-4.3 mm long; medium-sized, 3.0-3.8 mm; and small, 2.3-3.2 mm. All individuals of the large group are long winged or macropterous (Fig. 2A), but adults in the medium-sized (Fig. 2B) and small

(Fig. 2)



*Nysius huttoni*, dorsal views: A. Large macropterous adult. B. Medium-sized, sub-brachypterous adult. C. Small brachypterous adult (From Eyles 1960).

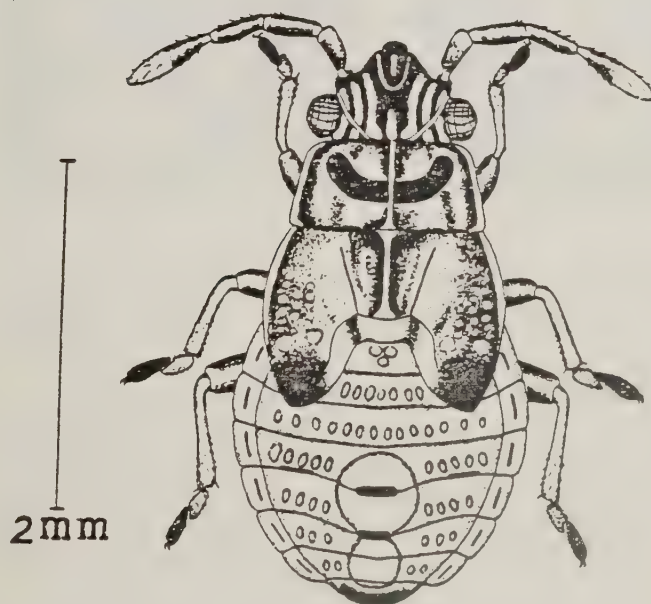


(Fig. 2C) groups have three forms ranging from macropterous, sub-brachypterous, to brachypterous (short winged) (Eyles 1960).

EGGS - Oval, length about three times width; mean length about 0.8 mm, mean width about 0.3 mm. Straw yellow to creamy white; cephalic (head) end more orange when first laid, deep orange when about to hatch (Eyles 1960).

NYMPHS (Fig. 3) - Generally pale gray to orange, marked with varying degrees of brown, black, and gray; length from about 0.5 mm in instar I to about 2.0 mm in instar V. Head dark brown to black with longitudinal pale gray to orange stripes. Instars I-IV with pronotum (and wing pads in instars III-IV) dark brown to black; in instar V, pronotum pinkish to gray, variously marked with brown and black, lateral margins and mesal line pale, apex of wing pads and broad U-shaped mark on pronotum black. Dorsal surface of abdomen grayish blue, each segment with transverse row of whitish spots surrounded by narrow red ring. Legs pale brown, spotted with black (Eyles 1960).

(Fig. 3)



Nysius huttoni fifth-instar nymph, dorsal view (From Eyles 1960).

Damage to wheat occurs in the milk-ripe stage (Fig. 4), usually in field edges. Affected kernels show a white or pale yellow oval patch up to 2 mm in diameter, usually on the cheek of the





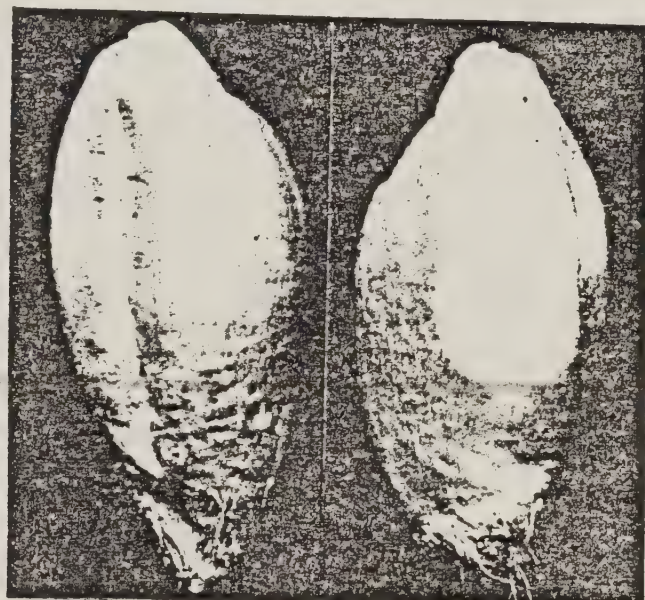
grain (Fig. 5). A black dot in the center of this patch marks the feeding site. Some grains shrink to a cuboid shape when much endosperm is removed, presumably by prolonged or multiple feeding (Ferro 1976, Gurr 1957).

Damage to crucifer seedlings appears generally through a field. A cankerous growth, induced by feeding punctures, ring the stems at ground level. The girdled seedlings collapse on their own or break in high winds (Gurr 1957).

Figs. 4-5)



4



5

4. Nysius huttoni adults feeding on wheat head. 5. Wheat grain: Left - normal. Right - damaged (From Ferro 1976).

etection  
otes

N. huttoni can move as nymphs or adults in commercial shipments of imported fruits and vegetables. Plant Protection and Quarantine (PPQ) inspects these shipments under Title 7, Part 319.56 of the Code of Federal Regulations. If fruits and vegetables are infested with N. huttoni, PPQ requires quarantine action, such as fumigation.

PPQ has intercepted only fully winged adults, possibly owing to their increased mobility by flight. This species was intercepted 13 times in the past 10 years from New Zealand. There were 9 on Actinidia chinensis (kiwi), 2 on Fragaria sp., 1 on Lophomyrtus sp., and 1 on Malus sp. (apple) from cargo. These plant species, except for Fragaria sp., are not recorded as hosts in the available references.

Submit adults for identification in alcohol or mounted dry on triangular points.

Wheat bug, Nysius huttoni





N. huttoni overwinters as adults under plant debris and at the base of weeds and grasses. Early in the season this pest is associated with weeds, but the bug moves to wheat as most weeds mature and wheat reaches the milk-ripe stage. Adults appear in large numbers during the summer on clover and other plants near wheat crops. They attack seedling cruciferous crops which provide the ideal open ground cover. Adults thrive under hot, dry conditions, preferring situations where sunlight reaches the ground; they are seldom found in dense vegetation. Adults hide under clods or debris on the ground when the temperature begins to fall in the evening and become active in the morning when the temperature rises. Rain inhibits activity (Gurr 1957).

Mating occurs during the summer, with a single copulation fertilizing a female for life. One female may deposit 1-74 eggs, usually in cracks in the soil (Ferro 1976).

Eggs hatch in about 10 days. Nymphs undergo five instars. The complete life cycle takes 50-65 days. There are at least three, possibly four, generations per year (Ferro 1976).

Eyles, A. C. Variations in the adult and immature stages of Nysius huttoni White (Heteroptera: Lygaeidae) with a note on the validity of the genus Brachynysius Usinger. Trans. R. Entomol. Soc. London 112(4):53-72; 1960.

Ferro, D. N., editor. New Zealand insect pests. Canterbury, New Zealand: Lincoln University College of Agriculture; 1976: 137, 148-150.

Gurr, L. Observations on the distribution, life history, and economic importance of Nysius huttoni (Lygaeidae: Hemiptera). N. Z. J. Sci. Technol. Sec. A, 38(7):710-714; 1957.

Meredith, P. "Bug" damage in wheat. New Zealand wheat review No. 11, 1968-70. New Zealand: Department of Scientific and Industrial Research, Crops Research Division and Wheat Research Institute; 1970: 49-53.

Myers, J. G. Insect pests of lucerne and clover. Observations in the Marlborough seed-growing area. N. Z. J. Agric. 23(3):156, 161-162; 1921.

Spiller, D.; Wise, K. A. J., compilers; Dale, P. S.; Maddison, P. A., editors. A catalogue (1860-1960) of New Zealand insects and their host plants. Wellington, NZ: Department of Scientific and Industrial Research DSIR Bull. 231; 1982.





### HELPFUL REFERENCES

1. An Introduction to the Study of Insects by Borror, DeLong, and Triplehorn, 1976, Holt, Rinehart, and Winston (for identification to family).
2. Destructive and Useful Insects by Metcalf, Flint, and Metcalf, 1962, McGraw-Hill Book Co. (covers the cosmopolitan pests).
3. Plant Protection in New Zealand by Atkinson and others, 1956; R. E. Owen, Government Printer, Wellington, New Zealand. 699 pages (covers most of the pests of New Zealand).
4. The Insects of Australia, CSIRO, 1970. Melbourne University Press, 1029 pages (many of the pests are the same and can be used for the identification to family).
5. New Zealand Insect Pest, Edited by D. N. Ferro, 1976, Published by Lincoln University College of Agriculture, Canterbury, New Zealand.
6. A Catalogue (1860 - 1960) of New Zealand Insects and Their Host Plants, Compiled by D. M. Spiller and K. A. J. Wise, DSIR Bulletin 231, 1982.



## INTERCEPTION PROCEDURES

1. The New Zealand Department of Scientific and Industrial Research (DSIR) will make pest determinations needed by the PPQ officer. The status of the pests of New Zealand is fairly well developed and the DSIR is technically capable of making accurate determinations. Final decisions on action or non-action status of pests intercepted in preclearance programs rests with the PPQ officer.
2. The primary pests of concern are in the family Tortricidae. If live larvae are found, note the grower's number and the number of boxes. Call the Apple and Pear Board and ask them to have the Senior Field Officer (MAF) pick up the specimen for identification. The officer will send all insects, mites, snails, etc. to the following locations:  
  
Auckland - Henderson - DSIR, Mt. Albert, North Island  
Hastings - DSIR, Levins, North Island  
Nelson - DSIR, Christchurch, South Island
- If the pest is identified as one of the three quarantine tortricids, the whole block is automatically rejected. The rejected block should be moved to an isolated area and have the red/yellow dots crossed out with a black marker. The rejected block may also be immediately exported elsewhere.
3. The same procedure should be followed for all other live pests. After the determination, check the Appropriate Quarantine Action section of packet to determine your action. If the pest is not listed there, have the Apple and Pear Board send a Telex prepared by you to the Biological Assessment Support Staff (BASS), Hyattsville, Maryland, for action. If the request is urgent, place an international telephone call. The telephone number for BASS is (301) 436-6653 and ask for Ed Miller, Russ Stewart, or Joyce Cousins.
4. In all cases, continue the inspection until 8,000 fruits have been inspected in case the identificaion is other than the pests we are concerned about.
5. If possible, interception records should be completed for all live interceptions of actionable pests. These records with specimens should be submitted to your area identifier upon your return to the United States. As many specimens as practical should be submitted with the PPQ 309's for confirmation. They then can be used for training or reference collections. Any interceptions which appear to be unique, representing a possible new host or distribution record should be brought back for confirmation.





## APPROPRIATE QUARANTINE ACTION

This section was prepared by the Biological Assessment Support Staff to aid the PPQ officer in New Zealand to select the correct action after a pest or pathogen is intercepted in the preclearance of apples or pests.

Part I is a list of species and genera that are associated with apples and the appropriate quarantine action. Part II is the same for pears. Part III is a list of families or higher taxa which require no quarantine action if found with apples or pears in predeparture clearance from New Zealand.

### Special Instructions for Mite and Mealybug Interceptions

PPQ officers in New Zealand are instructed not to reject or hold shipments for mites (Acari) or mealybug (Pseudococcidae). No quarantine significant mites or mealbugs have been intercepted on these hosts from New Zealand. Also all the mites and mealybugs cited in literature for these hosts are either not plant pests or are found in the United States.

To insure that the pest risk from these groups remain minimal, the PPQ officer should routinely submit interceptions of mites and mealybugs to their area identifier upon their return to the United States.

### Special Instructions for Ants Intercepted on Fruit

The following genera have been determined as reportable pests when not identified as a species established in the United States:

- Acromyrmex
- Atta
- Crematogaster
- Messor
- Pheidole
- Pogonomyrmex
- Solenopsis (subgenus Solenopsis only)
- Tetramorium

Ants in all other genera are nonreportable, and no quarantine action is required.

No quarantine action is required even for reportable interceptions if all of the intercepted specimens are members of the worker caste. The determination as to what caste the specimens belong to should be done by a specialist.

### Special Instructions for Insect Eggs Intercepted on Fruit

No quarantine action is required for eggs on New Zealand apples or pears if only one egg or egg mass is found during inspection.



## PART I

Pests and Pathogens Associated with Apples from New Zealand and the Appropriate Quarantine Action. This list has been compiled from literature and from interceptions made by PPQ Officers. Interceptions are indicated with an asterick.

Diseases (Fungi)

- Alternaria alternata (Fr.) Kiessler "storage rot" - no action
- Botrytis cinerea Pers. ex. Fr. "gray mold" - no action
- Coniothyrium pyrinum (Sacc.) Sheldon "circular spot" - no action
- Diaporthe pernicioso Marchal "storage rot" - no action
- Fusarium lateritium Nees "storage rot" - no action
- Glomerella cingulata (Stonem.) Schrenk & Spaulding "bitter rot" - no action
- Monilinia fructicola (Alderh. & Ruhl.) "brown rot" - no action
- Mycosphaerella pomi (Pass.) Lindau "apple spot" - no action
- Penicillium expansum Link ex. Thom. "blue mold" - no action
- Polyopeus purpureus var. verus Horne "storage rot" - no action
- Sclerotinia sclerotiorum (Lib.) de Bary "Sclerotinia storage rot" - no action
- Trichothecium roseum Link ex. Fr. "pink storage rot" - no action
- Venturia inaequalis (Cooke) Wint. "scab or black-spot" - no action

Insects

- \* Agrypnus variabilis (Cand.) (Elateridae) "a wireworm" - action required
- \* Alticinae (Chrysomelidae) "a flea beetle" - action required
- Aonidiella aurantii (Maskell) (Diaspididae) "California red scale" - no action
- Aphis gossypii Glover (Aphididae) "cotton aphid" - no action
- Aphis citricola Van der Goot (Aphididae) "spirea aphid" - no action
- \* Araecerus palmaris (Pascoe) (Anthribidae) "a fungus weevil" - action required
- Caliroa cerasi (L.) (Tenthredinidae) "pear sawfly" - no action





- \* Camponotus sp. (Formicidae) "a carpenter ant" - no action
- Coccus hesperidum L. (Coccidae) "brown soft scale" - no action
- Costelytra zealandica White (Scarabaeidae) "brown chafer" - action required
- \* Ctenopseustis obliquana (Walker) (Tortricidae) "brown headed leafroller" - action required
- Cydia pomonella (L.) (Tortricidae) "codling moth" - no action
- Cydia molesta (Busck) (Tortricidae) "Oriental fruit moth" - no action
- Dasineura mali (Kieffer) (Cecidomyiidae) "apple leaf curling midge" - no action
- \* Dictyotus caenosus (Westwood) (Pentatomidae) "native brown bug" - action required
- \* Dieuches notatus Dallas (Lygaeidae) "a lygaeid bug" - action required
- Edwardsiana australis (Froggat) (Cicadellidae) "apple leaf hopper" - no action
- \* Epiphyas postvittana (Walker) (Tortricidae) "light brown apple moth" - action required (no action for Hawaii)
- \* Eriosoma lanigerum (Hausmann) (Aphididae) "woolly apple aphid" - no action
- Eucolaspis brunnea Fabricius (Chrysomelidae) "bronze beetle" -action required
- \* Eurystylus australis Poppius (Miridae) "Australian crop mirid" - action required
- \* Glaucias amyoti (Dall.) (Pentatomidae) "a stink bug" - no action
- \* Gonipterus scutellatus Gyllenhal (Curculionidae) "a snout beetle" - action required
- Graphania mutans (Walker) (Noctuidae) "a cutworm" -action required
- \* Gymnetron pascuorum (Gyllenhal) (Curculionidae) "a snout beetle" - no action
- Helicoverpa armigera (Hubner) (Noctuidae) "Old World bollworm" - action required
- Heliothrips haemorrhoidalis (Bouche) (Thripidae) "greenhouse thrips" - no action
- \* Hemiberlesia rapax (Comstock) (Diaspididae) "greedy scale" - no action
- \* Hylastes ater (Paykull) (Scolytidae) "a bark beetle" - action required
- Icerya purchasi Maskell (Margarodidae) "cottony cushion scale" - no action



- Lepidosaphes ulmi (L.) (Diaspididae) "oystershell scale" - no action
- Limnophile skusei Hutton (Tipulidae) "a crane fly" - no action
- Lindingaspis rossi (Maskell) (Diaspididae) "an armored scale" - no action
- \* Listronotus bonariensis (Curculionidae) "a weevil" - action required
- \* Lyonetiidae (Lepidoptera) "a moth" - action required
- Macrosiphum euphorbiae (Thomas) (Aphididae) "potato aphid" - no action
- Macrosiphum roase (L.) (Aphididae) "rose aphid" - no action
- \* Nysius huttoni B. White (Lygaeidae) "wheat bug" - action required
- \* Opogona omoscopa (Meyrick) (Tineidae) "a moth" - no action
- Parlatoria camellidae Comstock (Diaspididae) "an armored scale" - no action
- Parlatoria pergandii Comstock (Diaspididae) "chaff scale" - no action
- \* Parlatoria pittospori Maskell (Diaspididae) "minor apple scale" -no action
- Periphyllus testudinacea (Ferne) (Aphididae) "an aphid" - no action
- Phenacoccus graminosus McKenzie (Pseudococcidae) "grass mealybug" - no action
- \* Phylloxera sp. (Phylloxeridae) - action required
- \* Planotortrix excessana (Walker) (Tortricidae) "apricot leafroller" - action required
- Plinthisus sp. (Lygaeidae) "a seed bug" - action required
- \* Pseudococcus affinis (Maskell) (Pseudococcidae) "obscure mealybug" - no action
- Pseudococcus calceolariae (Maskell) (Pseudococcidae) "citrophilus mealybug"- no action
- \* Pseudococcus longispinus (Targioni-Tozzetti) (Pseudococcidae) "longtailed mealybug" - no action
- \* Pyrgotis (= Capua) phagiatana (Walker) (Tortricidae) "a leafroller" - action required
- Quadraspidotus ostreaeformis (Curtis) (Diaspididae) "European fruit scale" - no action
- \* Quadraspidotus perniciosus (Comstock) (Diaspididae) "San Jose scale" - no action



- \* Rhopalosiphum padi (L.) (Aphididae) "an aphid" - no action
- Saissetia oleae (Olivier) (Coccidae) "black scale" - no action
- \* Scoparia sp. (Pyralidae) "a pyralid moth" - action required
- \* Sitona discoideus Gyllenhal (Curculionidae) "a weevil" - action required
- Thrips obscuratus (Crawford) (Thripidae) "a thrips" - action required

#### Mites

- Brevipalpus obovatus Donn. (Tenuipalpidae) "privet mite" - no action
- Bryobia praetiosa Koch (Tetranychidae) "clover mite" - no action
- \* Oribotritia sp. (Cryptostigmata) - no action
- \* Panonychus ulmi (Koch) (Tetranychidae) "European red mite" - no action
- \* Scheloribatos sp. (Cryptostigmata) - no action
- Tetranychus turkestanii Ugarev and Nikolski (Tetranychidae) "strawberry spider mite" - no action
- \* Tetranychus urticae Koch (Tetranychidae) "two-spotted spider mite" - no action

#### Mollusks

- \* Cionella lubrica (Muller) (Cionellidae) "a snail" - no action
- \* Vallonia excentrica Sterki (Valloniidae) "a snail" - no action





## PART II

Pests and Pathogens Associated with Pears from New Zealand and the Appropriate Quarantine Action. This list has been compiled from literature and from interceptions made by PPQ Officers. Interceptions are indicated with an asterick.

Diseases (Fungi)

Botrytis cinerea Pers. ex. Fr. "gray mold" - no action

Fabraea maculata Atk. "Fabraea scald" - no action

Glomerella cingulata (Stonem.) Schrenk & Spaulding "bitter rot" - no action

Penicillium expansum Link ex. Thom. "blue mold" - no action

Penicillium italicum Wehmer "storage mold" - no action

Phytophthora cactorum (Leb. & Cohn) Schroet "fruit rot" - no action

Sclerotinia sclerotiorum (Lib.) de Bary "Sclerotinia storage rot" - no action

Venturia pirina Aderh. "pear scab" - no action

Insects

Aphis citricola Van der Goot (Aphididae) "spirea aphid" - no action

Aphis gossypi Glover (Aphididae) "cotton aphid" - no action

Aulacaspis rosae (Bouche) (Diaspididae) "rose scale" - no action

Caliroa cerasi (L.) (Tenthredinidae) "pear sawfly" - no action

Costelytra zealandica White (Scarabaeidae) "brown chafer" - action required

Ctenopseustis obliquana (Walker) (Tortricidae) "brown headed leafroller" - action required

Cydia molesta (Busck) (Tortricidae) "Oriental fruit moth" - no action

Cydia pomonella (L.) (Tortricidae) "codling moth" - no action

Dasineura pyri (Bouche) (Cecidomyiidae) "pear leaf curling midge" - no action

\* Epiphyas postvittana (Walker) (Tortricidae) "light brown apple moth" - action required



- Eriosoma lanigerum (Hausmann) (Aphididae) "wooly apple aphid" - no action
- Eriosoma lanuginosa (Hartig) (Aphididae) "elm aphid" - no action
- Eucolaspis brunnea Fabricius (Chrysomelidae) "bronze beetle" - action required
- Heliothrips haemorrhoidalis (Bouche) (Thripidae) "greenhouse thrips" - no action
- Hemiberlesia rapax (Comstock) (Diaspididae) "greedy scale" - no action
- Icerya purchasi Maskell (Margarodidae) "cottony cushion scale" - no action
- Lecanium corni (Bouche) (Coccidae) "European fruit lecanium" - no action
- Lecanium persicae (Fabricius) (Coccidae) "European peach scale" - no action
- Lepidosaphes ulmi (L.) (Diaspididae) "oystershell scale" - no action
- Macrosiphum euphorbiae (Thomas) (Aphididae) "potato aphid" - no action
- Macrosiphum rosae (L.) (Aphididae) "rosa aphid" - no action
- Nezara viridula (L.) (Pentatomidae) "southern green stink bug" - no action
- \* Nysius huttoni B. White (Lygaeidae) "wheat bug" - action required
- Parlatoria pergandii Comstock (Diaspididae) "chaff scale" - no action
- Planotortrix excessana (Walker) (Tortricidae) "apricot leafroller" - action required
- \* Pseudococcus affinis (Maskell) (Pseudococcidae) "obscure mealybug" - no action
- Pseudococcus calceolariae (Maskell) (Pseudococcidae) "citrophilus mealybug" - no action
- \* Pseudococcus longispinus (Targioni-Tozzetti) (Pseudococcidae) "longtailed mealybug" - no action
- Quadraspidiotus ostreaeformis (Curtis) (Diaspididae) "European fruit scale" - no action
- Quadraspidotus perniciosus (Comstock) (Diaspididae) "San Jose scale" - no action
- Saissetia oleae (Olivier) (Coccidae) "black scale" - no action





Mites

Bryobia praetiosa Koch (Tetranychidae) "clover mite" - no action

Panonychus ulmi (Koch) (Tetranychidae) "European red mite" - no action

Phlytoptus pyri Pagenstecher (Eriophyidae) "pearleaf blister mite" - no action



## PART III

ARTHROPOD FAMILIES (ORDERS): NON-ACTIONABLE

The asterick indicates that the family or order has been intercepted with New Zealand apples or pears.

- |                                   |                                       |
|-----------------------------------|---------------------------------------|
| Acaridae (Acari)                  | Hydrophilidae (except Helophorus sp.) |
| *Anisopodidae (Diptera)           | (Coleoptera)                          |
| Anoetidae (Acari)                 | Hypoctoniidae (Acari)                 |
| Anthicidae (Coleoptera)           | Ibaliidae (Hymenoptera)               |
| Anthocoridae (Hemiptera)          | Ichneumonidae (Hymenoptera)           |
| Anystidae (Acari)                 | Isopoda                               |
| Ascidae (Acari)                   | Labidostommidae (Acari)               |
| Asilidae (Diptera)                | Lagriidae (Coleoptera)                |
| Astigmata (Acari)                 | Lampyridae (Coleoptera)               |
| Bdellidae (Prostigmata) (Acari)   | Languriidae (Coleoptera)              |
| Bethylidae (Hymenoptera)          | *Lathridiidae (Coleoptera)            |
| Bibionidae (Diptera)              | Lauxaniidae (Diptera)                 |
| Blastobasidae (Lepidoptera)       | Lonchopteridae (Diptera)              |
| Braconidae (Hymenoptera)          | Lucanidae (Coleoptera)                |
| Brentidae (Coleoptera)            | Lymexylidae (Coleoptera)              |
| *Calliphoridae (Diptera)          | Macrochelidae (Acari)                 |
| Cantharidae (Coleoptera)          | Mecoptera                             |
| Carabodidae (Acari)               | *Melandryidae (Coleoptera)            |
| Ceratopogonidae (Diptera)         | Melyridae (Coleoptera)                |
| Cerylonidae (Coleoptera)          | Mesostigmata (Acari)                  |
| Cheyletidae (Prostigmata) (Acari) | Micromalthidae (Coleoptera)           |
| Chilopoda                         | Milichiidae (Diptera)                 |
| Ciidae (Coleoptera)               | Monommidae (Coleoptera)               |
| *Chironomidae (Diptera)           | Muscidae (except Atherigona sp.)      |
| Cleridae (Coleoptera)             | (Diptera)                             |
| Collembola (except Sminthuridae)  | Mycetophagidae (Coleoptera)           |
| *Colydiidae (Coleoptera)          | Mycetophilidae (Diptera)              |
| Corylophidae (Coleoptera)         | Mymaridae (Hymenoptera)               |
| Cryptophagidae (Coleoptera)       | *Neuroptera                           |
| *Cryptostigmata (Acari)           | *Nitidulidae (Coleoptera)             |
| Cucujidae (Coleoptera)            | Noteridae (Coleoptera)                |
| *Dermaptera                       | Odonata                               |
| Diplopoda                         | Oedemeridae (Coleoptera)              |
| Dolichopodidae (Diptera)          | Oligotomidae (Embioptera)             |
| *Drosophilidae (Diptera)          | Orthoperidae (Coleoptera)             |
| Dryopidae (Coleoptera)            | Otitidae (Diptera)                    |
| Encyrtidae (Hymenoptera)          | Parasitidae (Acari)                   |
| Endomychidae (Coleoptera)         | Passalidae (Coleoptera)               |
| Enicocephalidae (Hemiptera)       | Pergidae (Hymenoptera)                |
| Ephemeroptera                     | *Phoridae (Diptera)                   |
| Erotylidae (Coleoptera)           | *Phytoseiidae (Acari)                 |
| Euglenidae (Coleoptera)           | Platystomatidae (Diptera)             |
| Eulophidae (Hymenoptera)          | Plecoptera                            |
| Eumenidae (Hymenoptera)           | Pseudoscorpionida                     |
| Eupelmidae (Hymenoptera)          | *Psocoptera                           |
| Histeridae (Coleoptera)           | Psychodidae (Diptera)                 |





Pteromalidae (Hymenoptera)	Sphaeroceridae (Diptera)
Ptilodactylidae (Coleoptera)	*Staphylinidae (Coleoptera)
*Ptinidae (Coleoptera)	Stigmaeidae (Acari)
Raphidiidae (Neuroptera)	*Syrphidae (Diptera)
Raphignathidae (Acari)	Tabanidae (Diptera)
*Reduviidae (Hemiptera)	Tachinidae (Diptera)
Rhagiidae (Acari)	Thelyphonida
Rhizophagidae (Coleoptera)	*Thysanura
Salpingidae (Coleoptera)	Trichogrammatidae (Hymenoptera)
Sarcophagidae (Diptera)	Trichoptera
Scaphidiidae (Coleoptera)	Trogositidae (Coleoptera)
*Scatopsidae (Diptera)	Trombidiidae (Acari)
Schizopteridae (Hemiptera)	Tydeidae (Acari)
Sciaridae (Diptera)	Veliidae (Hemiptera)
Sciomyzidae (Diptera)	*Vespidae (Hymenoptera)
Scorpionida	

Additional families (class) of Arthropods which require no action if found on commercial shipments of apples and pears from New Zealand.

- \*Acari (all mites) - See page 26 for instructions
- \*Carabidae (Coleoptera)
- \*Coccinellidae (Coleoptera)
- \*Dermestidae (Coleoptera)
- \*Diaspididae (Homoptera)
- \*Erythraeidae (Acari)
- \*Formicidae (Hymenoptera) - Does not require action in most situations, see page 26 for instructions
- \*Lyctidae (Coleoptera)
- \*Pseudococcidae (Homoptera) - See page 26 for instructions





NATIONAL AGRICULTURAL LIBRARY



1022312258

*Handwritten signature or mark*



NATIONAL AGRICULTURAL LIBRARY



1022312258